Measles and Measles Vaccine

Epidemiology and Prevention of Vaccine-Preventable Diseases

National Center for Immunization and Respiratory Diseases
Centers for Disease Control and Prevention

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Note to presenters:

Images of vaccine-preventable diseases are available from the Immunization Action Coalition website at http://www.vaccineinformation.org/photos/index.asp

Measles

- Highly contagious viral illness
- First described in 7th century
- Near universal infection of childhood in prevaccination era
- Common and often fatal in developing areas

Measles Virus

- Paramyxovirus (RNA)
- Hemagglutinin important surface antigen
- One antigenic type
- Rapidly inactivated by heat and light

Measles Pathogenesis

- Respiratory transmission of virus
- Replication in nasopharynx and regional lymph nodes
- Primary viremia 2-3 days after exposure
- Secondary viremia 5-7 days after exposure with spread to tissues

Measles Clinical Features

- **Incubation period 10-12 days**
- **Prodrome**
  - Stepwise increase in fever to 103°F or higher
  - Cough, coryza, conjunctivitis
  - Koplik spots (rash on mucous membranes)

Measles Clinical Features

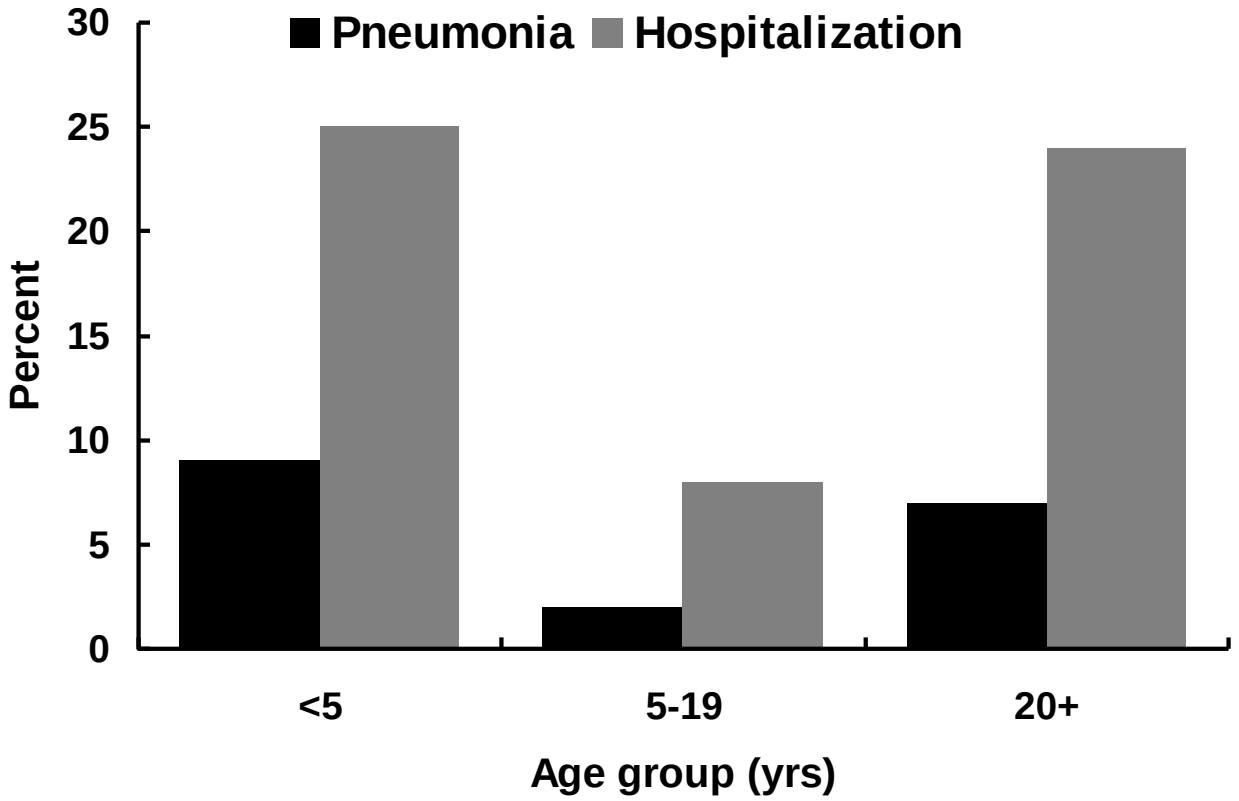
- **Rash**
  - 2-4 days after prodrome, 14 days after exposure
  - Maculopapular, becomes confluent
  - Begins on face and head
  - Persists 5-6 days
  - Fades in order of appearance

Measles Complications

Condition	Percent Reported
Diarrhea	8
Otitis media	7
Pneumonia	6
Encephalitis	0.1
Hospitalization	18
Death	0.2

Based on 1985 1992 surveillance data

Measles Complications by Age Group



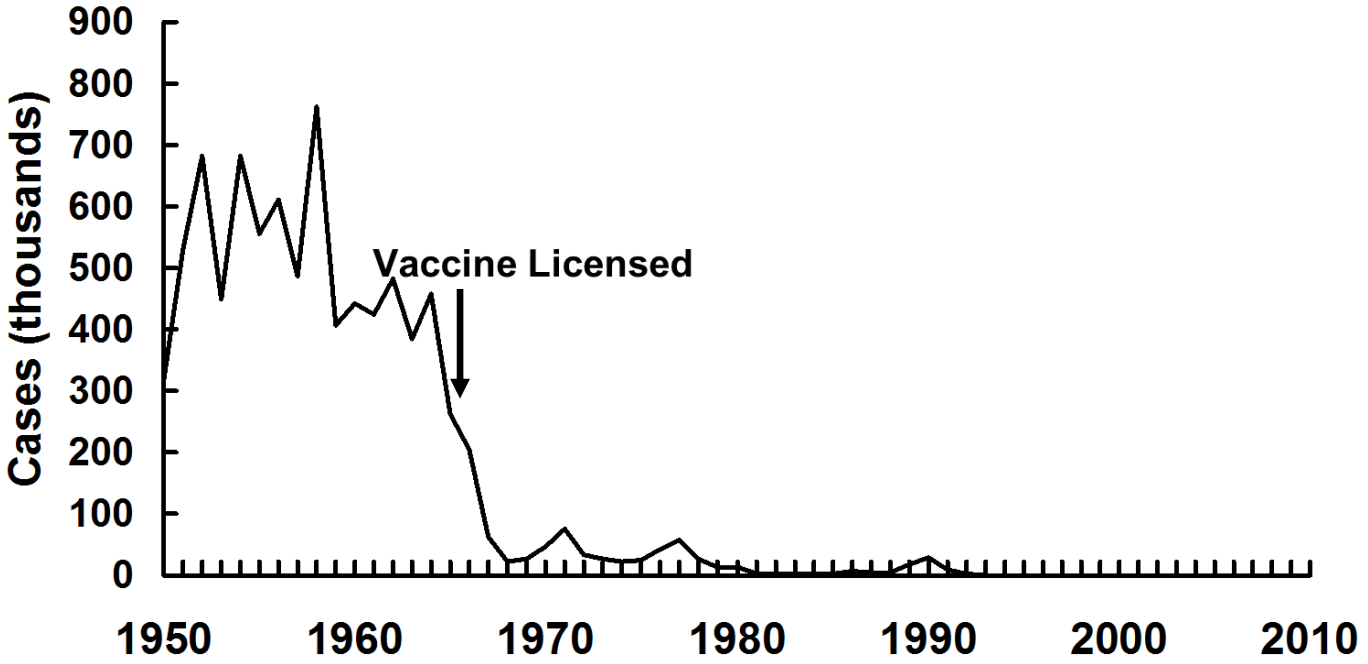
Measles Laboratory Diagnosis

- Isolation of measles virus from a clinical specimen (e.g., nasopharynx, urine)
- Significant rise in measles IgG by any standard serologic assay (e.g., EIA, HA)
- Positive serologic test for measles IgM antibody

Measles Epidemiology

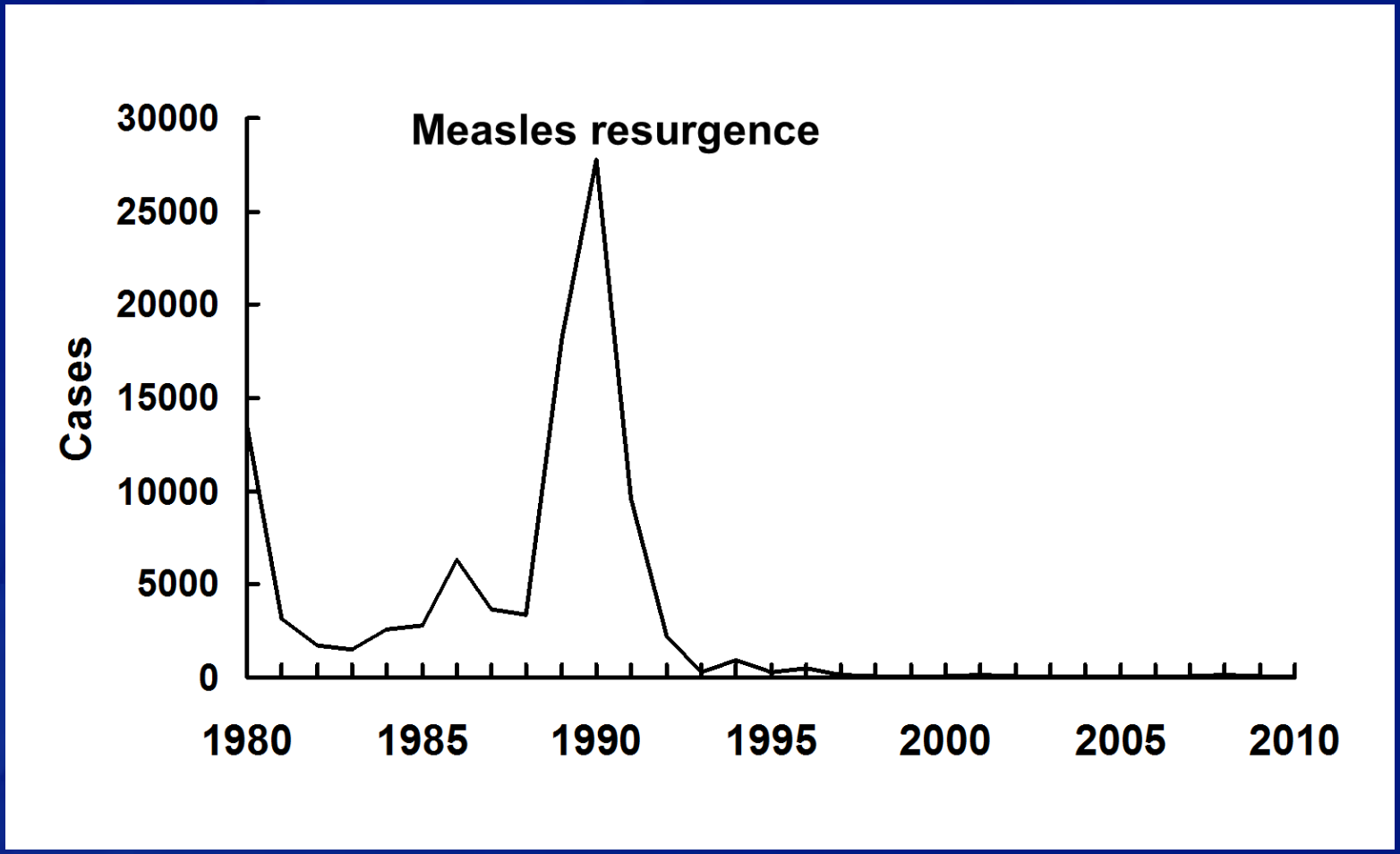
Reservoir	Human
Transmission	Respiratory Airborne
Temporal pattern	Peak in late winter–spring
Communicability	4 days before to 4 days after rash onset

Measles - United States, 1950-2010



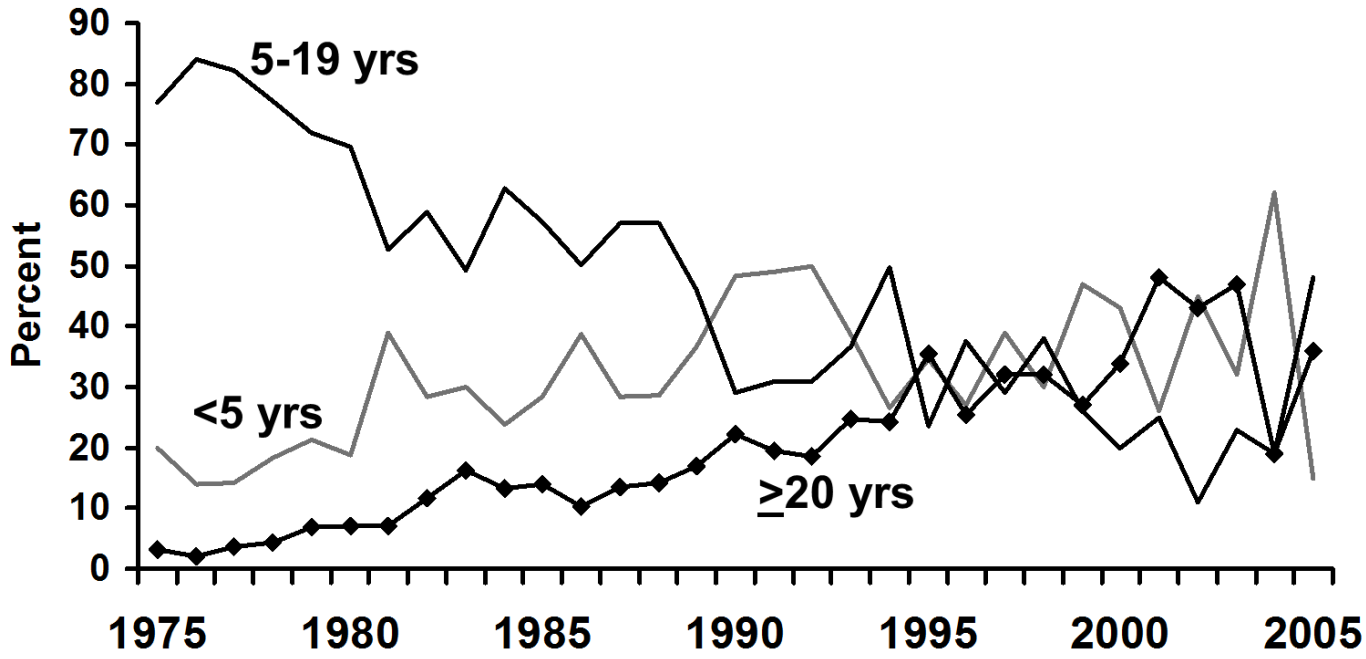
Source: National Notifiable Disease Surveillance System, CDC

Measles - United States, 1980-2010



Source: National Notifiable Disease Surveillance System, CDC

Age Distribution of Reported Measles, 1975-2005



Source: National Notifiable Disease Surveillance System, CDC

Measles Resurgence—United States, 1989-1991

Cases	55,622
Age group affected	Children <5 yrs
Hospitalizations	>11,000
Deaths	123
Direct medical costs	>$150 million

Measles 1993-2009

- Endemic transmission interrupted
- Record low annual total in 2004 (37 total cases)
- Many cases among adults
- Most cases imported or linked to importation
- Most persons with measles were unvaccinated or unknown vaccination status

Measles Clinical Case Definition

- Generalized rash lasting >3 days, and
- Temperature 101°F (>38.3°C), and
- Cough or coryza or conjunctivitis

Measles Vaccines

1963	Live attenuated and killed vaccines
1965	Live further attenuated vaccine
1967	Killed vaccine withdrawn
1968	Live further attenuated vaccine (Edmonston-Enders strain)
1971	Licensure of combined measles-mumps-rubella vaccine
1989	Two dose schedule
2005	Licensure of MMRV

Measles Vaccine

- **Composition** — Live virus
- **Efficacy** — 95% (range, 90%-98%)
- **Duration of Immunity** — Lifelong
- **Schedule** — 2 doses
- **Should be administered with mumps and rubella as MMR or with mumps, rubella and varicella as MMRV**
- **Single antigen vaccines are not available in the U.S.**

MMRV (ProQuad)

- Combination measles, mumps, rubella and varicella vaccine
- Approved children 12 months through 12 years of age (up to age 13 years)
- Titer of varicella vaccine virus in MMRV is more than 7 times higher than standard varicella vaccine

MMR Vaccine Failure

- Measles, mumps, or rubella disease (or lack of immunity) in a previously vaccinated person
- 2%-5% of recipients do not respond to the first dose
- Caused by antibody, damaged vaccine, record errors
- Most persons with vaccine failure will respond to second dose

Measles (MMR) Vaccine Indications

- All children 12 months of age and older
- Susceptible adolescents and adults without documented evidence of immunity

Measles Mumps Rubella Vaccine

- 12 months is the recommended and minimum age
- MMR given before 12 months should not be counted as a valid dose
- Revaccinate at 12 months of age or older

Second Dose of Measles Vaccine

- Intended to produce measles immunity in persons who failed to respond to the first dose (primary vaccine failure)
- May boost antibody titers in some persons

Second Dose of Measles Vaccine

- First dose of MMR at 12-15 months
- Second dose of MMR at 4-6 years
- Second dose may be given any time at least 4 weeks after the first dose

MMR and MMRV Vaccine

- For the first dose of measles, mumps, rubella, and varicella vaccines either MMR and varicella vaccines or MMRV vaccine can be used
- Providers should discuss the benefits and risks of both vaccination options with the parents or caregivers
- Unless the parent or caregiver expresses preference for MMRV, CDC recommends using MMR and varicella vaccines for the first dose.
- Providers who face barriers to clearly communicating benefits and risks for any reason, such as language barriers, should administer MMR and varicella vaccines separately

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MMR and MMRV Vaccine

- For the first dose of measles, mumps, rubella, and varicella vaccines administered at 48 months of age or older, and for second dose at any age, use of MMRV vaccine generally is preferred over separate injections of MMR and varicella vaccines

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Adults at Increased Risk of Measles

- College students
- International travelers
- Healthcare personnel

Measles Immunity in Healthcare Personnel

- All persons who work in a medical facilities should have evidence of immune to measles

Presumptive Evidence of Measles Immunity

- **Documentation of adequate vaccination**
  - 1 dose of MMR vaccine for preschool-aged children and for adults not at high risk of exposure
  - 2 doses for school-aged children (i.e., grades K-12) and for adults at high risk of exposure
- **Serologic evidence of immunity**
- **Birth before 1957**
- **Documentation of physician-diagnosed measles (not acceptable in HCP0)**

Measles Vaccine
Indications for Revaccination

- Vaccinated before the first birthday
- Vaccinated with killed measles vaccine
- Vaccinated prior to 1968 with an unknown type of vaccine
- Vaccinated with IG in addition to a further attenuated strain or vaccine of unknown type

MMR Vaccine
Contraindications and Precautions

- Severe allergic reaction to vaccine component or following prior dose
- Pregnancy
- Immunosuppression
- Moderate or severe acute illness
- Recent blood product
- Personal or family (i.e., sibling or parent) history of seizures of any etiology (MMRV only)

Measles and Mumps Vaccines and Egg Allergy

- Measles and mumps viruses grown in chick embryo fibroblast culture
- Studies have demonstrated safety of MMR in egg allergic children
- Vaccinate without testing

Measles Vaccine and HIV Infection

- MMR recommended for persons with asymptomatic and mildly symptomatic HIV infection
- NOT recommended for those with evidence of severe immuno- suppression
- HIV testing before vaccination is not recommended
- MMRV not approved for use in persons with HIV infection

Tuberculin Skin Testing (TST)* and Measles Vaccine

- Apply TST at same visit as MMR
- Delay TST at least 4 weeks if MMR given first
- Apply TST first and administer MMR when skin test read (least favored option because receipt of MMR is delayed)

*previously called PPD

MMR Adverse Reactions

Fever*	5%-15%
Rash*	5%
Joint symptoms	25%
Thrombocytopenia*	<1/30,000 doses
Parotitis	rare
Deafness	rare
Encephalopathy*	<1/1,000,000 doses

*reactions usually attributed to the measles component

MMRV Adverse Reactions

- MMRV has higher risk for fever and febrile seizures 5-12 days after the first dose among children 12-23 months of age
- 1 additional febrile seizure for every 2,300-2,600 MMRV vaccine doses administered

MMR Vaccine and Autism

- There is no scientific evidence that the risk of autism is higher among children who receive measles or MMR vaccine than among unvaccinated children

MMR Vaccine and Autism

"The evidence favors a rejection of a causal relationship at the population level between MMR vaccine and autism spectrum disorders (ASD)."

- Institute of Medicine, April 2001

Vaccine Storage and Handling
MMR Vaccine

- Store between 35o and 46oF (between 2o and 8oC) (may be stored in the freezer)
- Store diluent at room temperature or refrigerate
- Protect vaccine from light
- Discard if not used within 8 hours reconstitution

Vaccine Storage and Handling
MMRV Vaccine

- Must be stored at an average temperature of 5oF (-15oC) or colder at all times
- May be stored at refrigerator temperature for up to 72 hours but must then be discarded if not used (do not refreeze)
- Must be administered within 30 minutes of reconstitution or must be discarded

CDC Vaccines and Immunization

Contact Information

Telephone	800.CDC.INFO
Email	nipinfo@cdc.gov
Website	www.cdc.gov/vaccines